CLAIMS

Sub B1

1. A graphics system comprising a two-dimensional graphic imaging pipeline constructed and arranged to manipulate two-dimensional (2D) images and to composite separately generated three-dimensional (3D) images.

2. The graphics system of claim 1, wherein said two-dimensional images and said three-dimensional images are represented by pixel data.

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3. The graphics system of claim 1, wherein the graphics system comprises a rendering pipeline including,

a geometric pipeline constructed and arranged to generate a two-dimensional image from one or more model views represented by primitive data; and

said imaging pipeline.

4. The graphics system of claim 3, wherein operational components of said geometric pipeline are utilized by said imaging pipeline to composite said separately generated 3D images.

5. The graphics system of claim 1, wherein the graphics system further comprises a frame buffer for storing pixel data to be displayed on a display device, and wherein said 3D images to be composited comprise:

a stored image stored in the frame buffer; and

a next image to be composited with the stored image.

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6. ~~The graphics system of claim 5, wherein said next image is stored in a system memory.~~

7. The graphics system of claim 5, wherein said next image is stored in said frame buffer.

8. The graphics system of claim 1, wherein said imaging pipeline is constructed and arranged to perform depth test and stencil test operations to composite said 3D images.

~~9. The graphics system of claim 5, wherein said imaging pipeline processes portions of the next image separately and sequentially,~~

~~wherein initially, a depth test is performed to determine whether the stored or next image is to be rendered at each pixel, an indication of the determination being stored in a memory location associated with that pixel.~~

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~~10. The graphics system of claim 4, wherein said depth test is performed to determine initially which of the stored and next images is to be rendered at each pixel based on Z coordinate data of the stored and next images, wherein an indication of said selected image is stored in a memory location associated with that pixel.~~

~~11. The graphics system of claim 10, wherein said pixel data of said stored image and said next image comprise color data for each pixel, and~~

~~wherein said imaging pipeline writes color data to the frame buffer of one of either said stored or said next image based on said indications of said selected image.~~

~~12. The graphics system of claim 4, wherein said depth test is performed to determine initially which of said stored and next image is to be rendered at each pixel based on Z coordinate data of the two images, and wherein said stencil test is performed to control subsequent writing of color data of the composited images to the frame buffer based on the initial determination.~~

~~13. The graphics system of claim 12, wherein said initial determination and said subsequent filtering are performed on first and second components of said pixel data,~~

~~wherein said second component of said pixel data is processed by said imaging pipeline after said imaging pipeline completes processing of said first component of said pixel data.~~

Sub A4 cont.

Sub a4

~~14. The graphics system of claim 5, wherein said pixel data of said next image includes Z coordinate data, color data and X,Y coordinate data, wherein said image compositing module receives said Z coordinate data and said color data over a color data channel, and said X,Y coordinate data over an address data channel.~~

~~15. The graphics system of claim 14, wherein said image compositing module comprises:~~

~~a depth buffer configured to store Z coordinate data for each pixel in a display scene; and~~

~~coordinate data of said stored image and said Z coordinate data of said next image, and to store Z coordinate data of either said next or stored image that passed said depth test.~~

~~16. The graphics system of claim 3, wherein said image compositing module comprises:~~

~~a selector having a first input connected to said color data channel, a second input connected to a primitive data Z coordinate data channel, and an output connected to said depth test module,~~

~~wherein said selector connects said first input to said output when said 5 image compositng module is to composite said stored and next images.~~

~~17. The graphics system of claim 3, wherein said selector comprises a multiplexer.~~

Sub a5 cont.

~~18. The graphics system of claim 9, wherein said image compositing module further comprises:~~

~~a stencil buffer containing stencil bits for each pixel in the display scene; and~~

~~a stencil test module constructed and arranged to update said stencil buffer with a predetermined value indicating whether said stored image or said next image pass said depth 6 test,~~

~~wherein said imaging pipeline updates a color buffer with color data received over said color data channel when said stencil buffer indicates said depth test passed and said next image is to be rendered at a pixel in said composited image.~~

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~~19. The graphics of claim 1, wherein the computer graphics system further includes a graphics library and graphics hardware together defining the imaging pipeline, and a graphics application program invoking operations in the imaging pipeline through an application 4 program interface provided by the graphics library.~~

~~20. The graphics system of claim 19, wherein said graphics library comprises an OpenGL graphics library.~~

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~~21. A method for compositing 3D images in a 2D imaging pipeline to form a composited image comprising:~~

~~storing in a frame buffer a stored image including color data and Z coordinate data;~~

~~processing Z coordinate data of a next image to determine whether the stored or next image is to be rendered at each pixel in the composited image; and~~

~~replacing said stored color data with color data of said next image for each pixel at which the next image is to be rendered in the composited image at a pixel.~~

~~22. The method of claim 2 1, wherein said processing Z coordinate data comprises:~~

~~transferring Z coordinate data of the next image through an available data channel of imaging pipeline;~~

~~depth testing the stored and next images;~~

~~updating a depth buffer with Z coordinate data of a closest image; and~~

~~recording an indication of the closest image.~~

~~23. The method of claim 22, wherein said available data channel is a color data channel.~~

24. The method of claim 2 1, wherein the imaging pipeline consists of a color data channel and an address data channel, and wherein replacing the stored color data comprises:

routing selectively the color data channel to a depth test module.

25. The method of claim 21, wherein said storing comprises:

generating the stored image;

storing the stored image in system memory; and

transferring the stored image from the system memory to the frame buffer.

26. The method of claim 22, wherein the imaging pipeline consists of a color data channel and an address data channel, and wherein said transferring Z coordinate data comprises:

selecting a color data channel of the imaging pipeline to provide the next image Z coordinate data for the depth testing; and

transferring the next image Z coordinate data over the color data channel.

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27. The method of claim 26, wherein said transferring Z coordinate data further comprises:

masking data writes to the color buffer to prevent the next image Z coordinate data from being written to the color buffer.

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28. The method of claim 22, wherein said recording comprises:

performing a stencil test such that a stencil buffer is modified to reflect whether the stored or next image is closest to the viewpoint.

29. The method of claim 2 1, wherein replacing the stored color data comprises:

transferring the image color data over color data channel;

performing stencil test such that the stencil test passes for each pixel of the next image that is closer to the viewpoint that the stored image; and updating the color buffer in accordance with the stencil in stencil buffer thereby resulting in values in the color buffer that correspond to pixels that passed the depth testing.

30. A method for compositing a stored and a next three-dimensional image in an imaging/two-dimensional graphics pipeline configured to manipulate two-dimensional images represented by X,Y address and color data to form a composited image, the method comprising the steps of:

1) storing the stored image in a frame buffer of the imaging pipeline, wherein said stored image includes color data and Z coordinate data; and

2) processing successively potions of the next image through the imaging pipeline to select which of the next or stored image is closest to a viewpoint and to subsequently save color data of the selected image to the frame buffer.

Sub a8

31. A graphics system comprising an imaging pipeline configured to manipulate two-dimensional images and to composite separately generated three-dimensional images, comprising,

an image compositing module configured to perform depth testing and stencil testing on specific components of a next image, wherein said specific components are separately and sequentially processed by the imaging pipeline,

image is to be rendered at each pixel based on Z coordinate data of the two images, and

wherein said indetermination is used to determine subsequent writing of color data of the composited images to the frame buffer based on the first determination,

wherein said first determination is performed on Z coordinate data of the next image and said second determination is performed on color data of the next image.

32. The graphics system of claim 31, wherein said two-dimensional images and said three- dimensional images are represented by pixel data.

33. ~~The graphics system of~~ claim 31, wherein the graphics system comprises a rendering pipeline including,

a geometric pipeline constructed and arranged to create a two-dimensional image from one or more model views defined by primitive data; and said imaging pipeline.

34. The graphics system of claim 32, wherein said stencil test is performed to determine initially which of said stored and next images is to be rendered at each pixel based on Z coordinate data of the two images, wherein an indication of said selected image is stored in a memory location associated with that pixel.

35. A graphics system comprising a graphics application controlling a 2D imaging pipeline to composite a first 3D image and a second 3D image generated separately than the first image, wherein the pipeline processes Z coordinate data of the images to determine, for each pixel in the composited image, which of the first or second image is closest to a viewpoint, and causes color data of the closest image to be stored in a frame buffer for subsequent rendering on a display device.

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